Management of Strabismus Secondary to Ahmed Glaucoma Valve Implantation

Northport VAMC Optometry Residency in Primary Care, Low Vision Rehabilitation & Vision Therapy

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INTRODUCTION

- Ahmed glaucoma valve (AGV) implantation is often used to reduce intraocular pressure in cases of refractory glaucoma.[1] The valve consists of a plate, a drainage tube and a valve mechanism. The mechanism to reduce IOP involves the valve opening when a preset threshold value of IOP is reached and creating of a pressure differential across the chamber (Figure 1).[1]

- In addition to surgical complications such as choroidal effusion, hypotony, corneal edema, tube erosion and endophthalmitis, strabismus and diplopia may also occur after glaucoma valve implant surgery.[1,2]

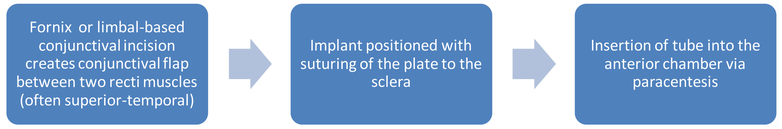

Figure 1: Surgical technique for Ahmed glaucoma valve (AGV) implantation.

- This case presentation highlights a rarer post-surgical complication of glaucoma surgery: left hypotropia and diplopia due to mechanical restriction of the left inferior oblique extraocular muscle, after Ahmed valve implantation.

CASE PRESENTATION

75-year-old white male presents for doctor-directed follow up for prism re-evaluation

- History of left hypotropia secondary to mechanical restriction after glaucoma filtration surgery
- Symptomatic for discomfort and difficulty adjusting to vision in bifocal spectacles with ground-in prism in left eye only; images in left eye appeared "larger and coming towards" him
- Denied diplopia at distance and near

<u>Ocular History</u>

- Ocular hypertension (possible bilateral Posner Schlossman syndrome)
  (+) Cosopt BID OU
  (+) s/p Ahmed shunt OD (July 2020), s/p Ahmed shunt OS (August 2020)
- Binocular vertical diplopia likely secondary to mechanical restriction of Ahmed plate to left inferior oblique muscle
- Lattice degeneration OU with retinal holes OU s/p retinopexy OD (2003), OS (2013)
- ERM OU with lamellar hole OS
- s/p CE with PCIOL OD/OS (2014)
- Dry eye syndrome OU

<u>Medical History</u>

- Benign prostatic hyperplasia, Hyperlipidemia, Osteoarthritis, Paroxysmal supraventricular tachycardia, Sleep apnea

<u>Medications</u>

- Meloxicam, Aspirin (81 mg)

PERTINENT EXAM FINDINGS

Habitual Rx with prism OS only OD: -0.50 -0.75 x 115 VA: 20/25^{-2} OS: -1.25 sph, 9.0 PD base up VA: 20/30
Red lens luster cc: unsteady; intermittent OS suppression @40cm, monocular diplopia @10ft
DCT cc: ortho/iso **DCT sc**: left hypotropia **NCT cc**: ortho/iso **NCT sc**: left hypotropia
EOM: full & smooth (-) diplopia **CVF**: FTFC OD/OS **Pupils**: PERRL (-)RAPD
Prior Maddox rod testing: non-comitant left hypo deviation worse in right gaze & worse on right head tilt
Repeat red lens luster cc with prism split between two eyes (after 15 min adaptation period): steady, stable luster @ 40 cm, 6 ft & 10 ft
Manifest Rx OD: -0.50 sph, 4.0 PD base down VA: 20/20- OS: -1.25 sph, 5.0 PD base up VA: 20/25-2 **Patient reports clear & single vision

Table 1: Testing at prism re-evaluation including objective cover test, subjective luster test, refraction & prior visit's Maddox rod testing.

3 Right Hyper (Right upgaze)	**3 Right Hyper** (Upgaze)	**5 Right Hyper** (Left upgaze)
10 Right Hyper (Right gaze)	**7 Right Hyper** (Primary gaze)	**6 Right Hyper** (Left gaze)
>10 Right Hyper (Right downgaze)	**9 Right Hyper** (Downgaze)	**4 Right Hyper** (Left downgaze)

Table 2: Maddox rod testing of the patient from examiner's perspective. Maddox rod placed in front of left eye.

DIAGNOSIS & MANAGEMENT

<u>Differential Diagnoses</u>

- *Left hypotropia secondary to left inferior oblique restriction*
- *Left hypotropia secondary to left superior rectus restriction*
- *Cranial nerve four palsy*
- *Brown syndrome*
- *Skew deviation*

- To isolate the paretic muscle the Parks Three -Step test was conducted:
  1) Which eye is deviated upward in primary gaze? **Right**
  2) Is the vertical deviation greater in right or left gaze? **Right**
  3) Is the vertical deviation greater with right or left head tilt? **Right**

  → **Left Inferior Oblique**

- Given the patient's onset of vertical binocular diplopia coinciding with his recent glaucoma surgery, the diagnosis of **left hypotropia secondary to a mechanical restriction of the left inferior oblique muscle after Ahmed valve implantation surgery** was agreed upon by the glaucoma clinic and optometry clinics.

- The spectacles were remade with **ground-in prism split between the two eyes** as follows: 4.5 PD base down OD and 4.5 PD base up OS, in a high-index material, with the updated refraction. Emphasized adaptation period. Patient noted improvement in vision/comfort at follow-up visit in 3-4 months.

DISCUSSION

- The diplopia after AGV implantation is postulated to be due to a restrictive strabismus, either from the plate itself or from the plate impinging on the muscle insertion.[1] Some studies implicate manipulation of the recti muscles during surgery in causing strabismus, but this usually resolves spontaneously in weeks or months.[1] There has also been mention of a mass effect, restriction induced by the implant or fat adherence, scarring of the muscle or displacement of the muscle path causing postoperative strabismus.[8]

  ➔ Post-operative prevalence of **strabismus**: between 2.1% and 77%
  ➔ Post-operative prevalence of **diplopia**: between 1.4% and 23%

- Spontaneous resolution of diplopia after an average of **five months** in patients who were initially treated with prism glasses and spontaneous resolution of diplopia after approximately **six months** in untreated patients.[2]

- Management of diplopia includes observation, occlusion, prismatic correction and surgery.

CONCLUSIONS

- When a patient presents with new-onset binocular diplopia, appropriate case history is critical in assessment of the etiology (i.e. traumatic, mechanical, neurologic).

- Acquired vertical diplopia is rare and the Parks Three-Step test enables quick isolation of the paretic muscle.

- Evaluation of ocular motility with unilateral and alternate cover test and Maddox rod in the diagnostic positions of gaze offers objective and subjective quantification, respectively. Red lens luster testing is invaluable to assess a patient's binocular sensory status in free-space.

- Although strabismus and diplopia are not postoperative complications often at the forefront after glaucoma surgery, they are complications that should be discussed with patients, especially in those with good binocular vision.

- Temporary (I.e. Fresnel prism) or long-term (I.e. ground-in prism) prismatic correction can significantly improve symptoms that affect aspects of everyday life, including reading, driving and mobility.

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